AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (currently amended) A process for detection of cardiac movement comprising:

a. acquiring a series of successive images I_n of the region of a heart;

b. determination of a cranio-caudal axis of the heart;~~analyzing at least some of the images thus acquired to identify a heart movement; and~~

c. for each image I_n, calculation of the series of images of a set of attenuation coefficients of points on the image representing vessels in the region of the heart, the set of attenuation coefficients along lines perpendicular to the cranio-caudal axis of the heart;~~determining the cardiac cycle starting from this movement.~~

d. calculation of the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} of the series of images starting from the set of attenuation coefficients calculated for each of the two successive images; and

e. determination of the cardiac cycle starting from all previously calculated integral displacements.

2. (cancelled)

3. (currently amended) The process according to claim [[2]] 1 wherein step b comprises:

b1. for each image I_n in the series of images, calculation of an associated thresholded image IS_n, only keeping vessels in the heart region, and

b2. determine all attenuation coefficients for points on the image starting from thresholded images along lines perpendicular to the axis of the heart.

4. (original) The process according to claim 3 wherein the step to calculate the thresholded image IS_n comprises:

b1i. determination of at least one dimension, particularly a diameter, of vessels in the heart region to be kept;

b1ii. calculation of a closing image starting from the maximum dimension of vessels in the heart region to be kept;

b1iii. calculation of an intermediate image by subtracting the closing image from the initial image; and

b1iv. calculation of the thresholded image by application of an appropriate thresholding on the intermediate image.

5. (original) Process according to claim 4 wherein the thresholding is applied such that it keeps only about 15% of the pixels in the intermediate image.

6. (currently amended) The process according to claim [[2]] 1 wherein the set of attenuation coefficients of points on image I_n along line i is modeled by a linear integral $f_{In}(i)$ of these attenuation coefficients along this line.

7. (original) The process according to claim 3 wherein the set of attenuation coefficients of points on image I_n along line i is modeled by a linear integral $f_{In}(i)$ of these attenuation coefficients along this line.

8. (original) The process according to claim 4 wherein the set of attenuation coefficients of points on image I_n along line i is modeled by a linear integral $f_{In}(i)$ of these attenuation coefficients along this line.

9. (original) The process according to claim 5 wherein the set of attenuation coefficients of points on image I_n along line i is modeled by a linear integral $f_{In}(i)$ of these attenuation coefficients along this line.

10. (original) The process according to claim 6 wherein the linear integral is expressed by a formula for line i, $f_{In}(i) = \sum_{\int m0}^{Nb.of\ columns} \ln \frac{I_n(i,j)}{I_{0n}(i,j)}$ where $I_n(i,j) =$ $R_{00}e^{-\int_{C(V)}\mu(x)dx-\int_{C(F)}\mu(x)dx}$ and $I_{0n}(i,j) = R_{00}e - \int_{C(F)}\mu(x)dx$,

where:

R_{00} is the initial intensity of radiation;

C(M) is the path between a radiation source and a point M on an image I_n with coordinates (i,j) in pixels on the image;

μ is the local attenuation coefficient along path C (M) that depends on the nature of the tissues crossed and the wavelength of the radiation used;

V represents all points on image I_n belonging to the projected vessels through which the radiation pass; and

F represents all points belonging to other tissues projected onto image I_n.

11. (original) The process according to claim 7 wherein the linear integral is expressed by a formula for line i, $f_{In}(i) = \sum_{\int m0}^{\text{Nb. of columns}} \ln \frac{I_n(i,j)}{I_{0n}(i,j)}$ where $I_n(i,j) =$ $R_{00}e^{-\int_{C(V)}\mu(x)dx-\int_{C(F)}\mu(x)dx}$ and $I_{0n}(i,j) = R_{00}e - \int_{C(F)}\mu(x)dx$,

where:

R_{00} is the initial intensity of radiation;

C (M) is the path between a radiation source and a point M on an image I_n with coordinates (i,j) in pixels on the image;

μ is the local attenuation coefficient along path C (M) that depends on the nature of the tissues crossed and the wavelength of the radiation used;

V represents all points on image I_n belonging to the projected vessels through which the radiation pass; and

F represents all points belonging to other tissues projected onto image I_n.

12. (original) The process according to claim 8 wherein the linear integral is expressed by a formula for line i, $f_{In}(i) = \sum_{\int m0}^{\text{Nb. of columns}} \ln \frac{I_n(i,j)}{I_{0n}(i,j)}$ where $I_n(i,j) =$ $R_{00}e^{-\int_{C(V)}\mu(x)dx-\int_{C(F)}\mu(x)dx}$ and $I_{0n}(i,j) = R_{00}e - \int_{C(F)}\mu(x)dx$,

where:

R_{00} is the initial intensity of radiation;

C (M) is the path between a radiation source and a point M on an image I_n with coordinates (i,j) in pixels on the image;

μ is the local attenuation coefficient along path C (M) that depends on the nature of the tissues crossed and the wavelength of the radiation used;

V represents all points on image I_n belonging to the projected vessels through which the radiation pass; and

F represents all points belonging to other tissues projected onto image I_n.

13. (original) The process according to claim 9 wherein the linear integral is expressed by a formula for line i, $f_{In}(i) = \int_{m0}^{Nb.of\ columns} \sum \ln \frac{I_n(i,j)}{I_{0n}(i,j)}$ where $I_n(i,j) = R_{00} e^{-\int_{C(V)} \mu(x)dx - \int_{C(F)} \mu(x)dx}$ and $I_{0n}(i,j) = R_{00} e - \int_{C(F)} \mu(x)dx$,

where:

R_{00} is the initial intensity of radiation;

C (M) is the path between a radiation source and a point M on an image I_n with coordinates (i,j) in pixels on the image;

μ is the local attenuation coefficient along path C (M) that depends on the nature of the tissues crossed and the wavelength of the radiation used;

V represents all points on image I_n belonging to the projected vessels through which the radiation pass; and

F represents all points belonging to other tissues projected onto image I_n.

14. (currently amended) The process according to claim[[s]] 6 wherein the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} is calculated starting from all linear integrals associated with each successive image.

15. (currently amended) The process according to claim[[s]] 7 wherein the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} is calculated starting from all linear integrals associated with each successive image.

16. (currently amended) The process according to claim[[s]] 8 wherein the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} is calculated starting from all linear integrals associated with each successive image.

17. (currently amended) The process according to claim[[s]] 9 wherein the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} is calculated starting from all linear integrals associated with each successive image.

18. (currently amended) The process according to claim[[s]] 10 wherein the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} is calculated starting from all linear integrals associated with each successive image.

19. (original) The process according to claim 14 wherein the integral displacement is the value of $k_{n,n+1}$ that minimizes an $F_{n,n+1}(k_{n,n+1}) = \sum_i \left| f_{I_n}(i) - f_{I_{n-1}}(i - k_{n,n+1}) \right|$ type cost function.

20. (original) The process according to claim 7 wherein the integral displacement is the value of $k_{n,n+1}$ that minimizes an $F_{n,n+1}(k_{n,n+1}) = \sum_i \left| f_{I_n}(i) - f_{I_{n-1}}(i - k_{n,n+1}) \right|$ type cost function.

21. (original) The process according to claim 8 wherein the integral displacement is the value of $k_{n,n+1}$ that minimizes an $F_{n,n+1}(k_{n,n+1}) = \sum_i \left| f_{I_n}(i) - f_{I_{n-1}}(i - k_{n,n+1}) \right|$ type cost function.

22. (original) The process according to claim 9 wherein the integral displacement is the value of $k_{n,n+1}$ that minimizes an $F_{n,n+1}(k_{n,n+1}) = \sum_i \left| f_{I_n}(i) - f_{I_{n-1}}(i - k_{n,n+1}) \right|$ type cost function.

23. (original) The process according to claim 10 wherein the integral displacement is the value of $k_{n,n+1}$ that minimizes an $F_{n,n+1}(k_{n,n+1}) = \sum_i \left| f_{I_n}(i) - f_{I_{n-1}}(i - k_{n,n+1}) \right|$ type cost function.

24. (original) The process according to claim 1 comprising:

f. choose a subset of synchronous images in the heart cycle from the series of images, starting from the previously determined cardiac cycle.

25. (currently amended) The process according to claim [[10]] 24 comprising:

g. determine an integral displacement due to breathing of a patient between synchronous images, the determination being done in the same way as in step c.

26. (currently amended) A radiography apparatus comprising:

~~means for providing~~ a source of radiation;

~~means for recording images~~ an image recorder facing the source; and

means for support placed between the source and the ~~means for recording images~~ image recorder on which there is a patient for whom a region of a heart is to be imaged,

wherein the radiography apparatus comprises means for implementing the process of claim 1.

27-28. (cancelled)

29. (currently amended) An article of manufacture for use with a computer system, the article of manufacture comprising a computer readable medium having computer readable program code means embodied in the medium, the program code means comprising:

a. computer readable program code means embodied in the medium for causing a computer to provide acquiring a series of successive images I_n of the region of a heart;

b. computer readable program code means embodied in the medium for causing a computer to provide ~~analyzing at least some of the images thus acquired to identify a heart movement; and~~ determination of a cranio-caudal axis of the heart;

c. computer readable program code means embodied in the medium for causing a computer to provide ~~determining the cardiac cycle starting from this movement.~~ for each image I_n, calculation of the series of images of a set of attenuation coefficients of points on the image representing vessels in the region of the heart, the set of attenuation coefficients along lines perpendicular to the cranio-caudal axis of the heart;

d. calculation of the integral displacement $k_{n,n+1}$ between two successive images I_n and I_{n+1} of the series of images starting from the set of attenuation coefficients calculated for each of the two successive images; and

e. determination of the cardiac cycle starting from all previously calculated integral displacements.